August 8, 2007

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN, P1-35
Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

**TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 1 - DOCKET 50-259 - FACILITY OPERATING LICENSE DPR - 33 - LICENSEE EVENT REPORT (LER) 50-259/2007-005-00**

The enclosed report provides details of an automatic reactor scram due to turbine trip as a result of invalid high level in moisture separator drain tank.

TVA is reporting this in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., Reactor Protection System including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system). There are no commitments contained in this letter.

Sincerely,

Original signed by:

Brian O'Grady

cc: See page 2

Enclosure
cc (Enclosure):

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NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2007

Estimated burden per response to comply with this mandatory collection request:: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. PAGE |
|---|---|---|
| Browns Ferry Unit 1 | 05000259 | 1 of 6 |

**4. TITLE:** Automatic Reactor Scram Due To Turbine Trip As A Result Of Invalid High Level In Moisture Separator Drain Tank

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | None | N/A |
| 06 | 09 | 2007 | 2007 | 005 | 00 | 08 | 08 | 2007 | FACILITY NAME None | DOCKET NUMBER N/A |

**9. OPERATING MODE**
1

**10. POWER LEVEL**
080

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:** *(Check all that apply)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20.2201(b) | | 20.2203(a)(3)(i) | | 50.73(a)(2)(i)(C) | | 50.73(a)(2)(vii) |
| | 20.2201(d) | | 20.2203(a)(3)(ii) | | 50.73(a)(2)(ii)(A) | | 50.73(a)(2)(viii)(A) |
| | 20.2203(a)(1) | | 20.2203(a)(4) | | 50.73(a)(2)(ii)(B) | | 50.73(a)(2)(viii)(B) |
| | 20.2203(a)(2)(i) | | 50.36(c)(1)(i)(A) | | 50.73(a)(2)(iii) | | 50.73(a)(2)(ix)(A) |
| | 20.2203(a)(2)(ii) | | 50.36(c)(1)(ii)(A) | X | 50.73(a)(2)(iv)(A) | | 50.73(a)(2)(x) |
| | 20.2203(a)(2)(iii) | | 50.36(c)(2) | | 50.73(a)(2)(v)(A) | | 73.71(a)(4) |
| | 20.2203(a)(2)(iv) | | 50.46(a)(3)(ii) | | 50.73(a)(2)(v)(B) | | 73.71(a)(5) |
| | 20.2203(a)(2)(v) | | 50.73(a)(2)(i)(A) | | 50.73(a)(2)(v)(C) | | OTHER |
| | 20.2203(a)(2)(vi) | | 50.73(a)(2)(i)(B) | | 50.73(a)(2)(v)(D) | | specify in Abstract below or in NRC Form 366A |

**12. LICENSEE CONTACT FOR THIS LER**

| NAME | TELEPHONE NUMBER *(Include Area Code)* |
|---|---|
| Steve Austin, Licensing Engineer, Licensing and Industry Affairs | 256-729-2070 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

**14. SUPPLEMENTAL REPORT EXPECTED**

☐ YES *(if yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

| 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
|---|---|---|---|
| | N/A | N/A | N/A |


ABSTRACT (*Limit to 1400 spaces, i.e., approximately 15 single-spaced type written lines*)

On June 9, 2007, at approximately 1100 hours central daylight time (CDT) Unit 1 automatically scrammed following a turbine trip from a 1A2 main steam moisture separator tank high level signal. Prior to the scram, at 1019 hours CDT, the Moisture Separator Reservoir High Level Dump Valve was noted opening. At approximately 1040 hours CDT operations received a low level alarm for the 1A2 moisture separator. Subsequently, at approximately 1100 hours CDT a turbine trip signal was initiated from an indicated main steam moisture separator high tank level. This was followed by an automatic reactor scram. The root cause of the event is the sizing of the Moisture Separator 1A2 Level Control Dump Valve. TVA is reviewing the design for the Moisture Separator Dump Valve and controls to determine if modifications are required. If necessary will either modify or replace the Unit 1 valves and controls.

**NARRATIVE** *(If more space is required, use additional copies of NRC Form 366A) (17)*

## I. PLANT CONDITION(S)

Prior to the event, Unit 1 was operating at approximately 80 percent of rated thermal power (RTP) (2732 megawatts thermal). Units 2 and 3 were operating in Mode 1 at 100 percent RTP (3458 megawatts thermal). Units 2 and 3 were unaffected by the event.

## II. DESCRIPTION OF EVENT

### A. Event:

On June 9, 2007, at approximately 1100 hours central daylight time (CDT) Unit 1 automatically scrammed following a turbine trip from a 1A2 main steam moisture separator tank high level [SB] signal. Prior to the scram, at 1019 hours CDT, the Moisture Separator Reservoir High Level Dump Valve [LCV] was noted opening. At approximately 1040 hours CDT operations received a low level alarm for the 1A2 Moisture Separator. Subsequently, at approximately 1100 hours CDT a turbine trip signal was initiated from an indicated main steam moisture separator high tank level. This was followed by an automatic reactor scram.

During the event, all automatic functions resulting from the scram occurred as expected. All control rods [AA] inserted. The reactor water level lowered below level 3, 528 inches, therefore; primary containment isolation system (PCIS) [JE] isolations Group 2 (residual heat removal (RHR) system [BO] shutdown cooling), Group 3 (reactor water cleanup (RWCU) system) [CE], Group 6 (ventilation), and Group 8 (traversing incore probe (TIP) system) [IG] were received along with the auto start of the control room emergency ventilation (CREV) [VI] system and the three standby gas treatment (SGT) [BH] system trains. Reactor water level remained above level 2, 470 inches; accordingly, no emergency core cooling systems were actuated. Reactor water level and heat rejection was maintained by the feedwater [SJ] and condensate [SG] system. The reactor pressure was controlled by the main steam system bypass valves [JI].

During the event, TIP D failed to automatically withdraw and isolate on PCIS Group 8 isolation signal. TIP D was manually withdrawn and the ball valve automatically closed.

The PCIS actuations were reset by 1112 hours CDT and SGT and CREV systems were secured by approximately 1117 hours CDT.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., reactor protection system including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system).

### B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

### C. Dates and Approximate Times of Major Occurrences:

| | |
|---|---|
| June 9, 2007 at 1100 hours CDT | Unit 2 received an automatic reactor scram. |
| June 9, 2007 at 1453 hours CDT | TVA made a four hour non-emergency report per 10 CFR 50.72(b)(2)(iv)(B) and an eight hour |

non-emergency report per 10 CFR 50.72(b)(3)(iv)(A).

June 9, 2007 at 1750 hours CDT — TVA made a follow-up notification to inform NRC that TIP D failed to withdraw on a PCIS Group 8 signal.

**D. Other Systems or Secondary Functions Affected**

None.

**E. Method of Discovery**

The turbine trip and reactor scram were immediately apparent to the control room staff through numerous alarms and indications.

**F. Operator Actions**

Operations personnel responded to the event according to applicable plant procedures. Operations momentarily entered Emergency Operating Instruction, 1-EOI-1, Reactor Pressure Control, and Abnormal Operating Instruction, 1-AOI-100-1, Reactor Scram, as required. All operator actions taken in response to the scram were appropriate. These included the verification that the reactor had shutdown, the expected system isolations and indications had occurred, and subsequent restoration of these systems to normal post scram alignment.

Additionally, operations personnel responded to the failure of TIP D to automatically withdraw and isolate on PCIS Group 8 signal by manually withdrawing TIP D. The ball valve automatically closed.

**G. Safety System Responses**

The RPS [JC] logic responded to the turbine trip per design to initiate the reactor scram. All control rods inserted. The PCIS Group 2 (RHR system shutdown cooling), Group 3 (RWCU system), Group 6 (ventilation), and Group 8 (TIP) isolations were received as expected, due to the lowering of the reactor water level, along with the auto start of the CREV system and the three SGT system trains. Reactor level was automatically restored with reactor feed water; therefore, emergency core cooling system actuation was not required.

TIP D did not automatically retract and isolate. However, simple operator actions withdrew the TIP. The ball valve automatically isolated.

## III. CAUSE OF THE EVENT

**A. Immediate Cause**

The immediate cause of the reactor scram was high moisture separator water level signal which initiated the turbine trip and subsequent reactor scram.

The TIP failed to automatically withdraw and isolate following the reactor scram on PCIS Group 8 signal due to a failed solder joint.

**B. Root Cause**

The root cause of the event is the sizing of the Moisture Separator 1A2 Level Control Dump Valve. The dump valve is over-sized for the application. Sizing of the dump valve was based on incorrect parameters.

The level control dump valve in Unit 1 is a 6 inch valve, and is sized for capacity based on the normal drain valve which is also a 6 inch valve. A review of the valve data sheet determined that the assumed valve inlet and outlet pressures for both valves were the same for both the normal drain and the dump valves. The data sheet for the valves indicates an inlet pressure of 235 psia and an outlet pressure of 136 psia. However, the dump valves have an additional 30 feet of head at the valve inlet and the outlet is at condenser vacuum.

It is not known how the solder joint failed.

**C. Contributing Factors**

A leak in a compression fitting in the Feedwater Heater and Moisture Separator Level Control Panel resulted in the loss of the instrument sense-line fill fluid for the 1A2 moisture separator level control system caused the instrument to sense a false high water level in the moisture separator drain tank and open 1-LCV-006-0061B.

## IV. ANALYSIS OF THE EVENT

Six moisture separators remove moisture from the steam exiting the high pressure turbine before going to the low pressure turbines. The condensate level in the moisture separators is controlled by the level in the associated moisture separator level control (drain) tanks. Two Level Indicating Controllers [LIC] are installed on each drain tank. To protect the turbine from excess condensate, a turbine trip is initiated on a high water level in any of the six moisture separators by actuating any 2 of the 3 high level turbine trip level switches on each moisture separator for > 0.5 seconds. Each moisture separator level control tank has a Moisture Separator Normal Drain Valve and the Moisture Separator Dump Valve. If the normal level control valve cannot maintain normal level (i.e., high condensate level in the level control tank), the dump valve then controls level.

A combination of several issues led to the reactor scram. A leak in a compression fitting in the Moisture Separator 1A2 level control panel resulted in a loss of sense-line fill fluid. The loss of sense-line fill caused the instrument to sense a false high water level in the moisture separator drain tank and opened the dump valve. Once the dump valve is opened, most of the condensate drained from the moisture separator, and the level control tank. The remaining condensate was subject to condenser vacuum and flashed to steam. The pressure wave from the flashing steam actuated the high level float switches leading to the turbine trip and subsequent reactor scram.

## V. ASSESSMENT OF SAFETY CONSEQUENCES

The safety consequences of this event were not significant. The reactor scram was not complicated. All safety systems operated as required. PCIS groups 2, 3, 4, 6, and 8 isolations were as expected. One exception was TIP D did not automatically retract and isolate. However, simple operator actions withdrew and isolated TIP D. Operator actions were appropriate and consistent with plant procedures. Reactor water level lowered to level 3, but remained above level 2; therefore, ECCS systems did not actuate. Reactor water level was recovered and maintained by the reactor feed pumps.

**NARRATIVE** *(If more space is required, use additional copies of NRC Form 366A) (17)*

Reactor scram from a turbine trip from 100% power is a transient for which BFN is analyzed. Therefore, TVA concludes that the health and safety of the public was not affected by this event.

## VI. CORRECTIVE ACTIONS

### A. Immediate Corrective Actions

Operations personnel placed the reactor in a stable condition in accordance with plant procedures.

Operations personnel responded to the failure of TIP D to automatically withdraw and isolate on PCIS group 8 isolation signal by manually completing the actions.

### B. Corrective Actions to Prevent Recurrence [1]

TVA is reviewing the design for the Moisture Separator Dump Valve and controls to determine if modifications are required. If necessary will either modify or replace the Unit 1 valves and controls.

Compression fittings associated with the Unit 1 Feedwater Heater [SJ], Moisture Separator level, and Main Steam [SB] instrument panels were checked and tightened as necessary. The individuals that performed the task associated with the compression fittings are no longer employed at BFN, therefore recurrence control with them cannot be taken.

TVA repaired the failed solder joint.

## VII. ADDITIONAL INFORMATION

### A. Failed Components

None.

### B. Previous LERs on Similar Events

None.

### C. Additional Information

Corrective action document for the reactor scram is PER 126054.

### D. Safety System Functional Failure Consideration:

No safety functions were compromised as a result of this event. Therefore, this event is not considered a safety system functional failure in accordance with NEI 99-02 in that functional capability of the overall system was not justified.

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(1) TVA does not consider these corrective actions as regulatory requirements. The completion of these actions will be tracked in TVA's Corrective Action Program.

E. **Loss of Normal Heat Removal Consideration:**

The condenser remained available, providing a normal heat removal path following the reactor scram. Accordingly, this event did not result in a scram with a loss of normal heat removal as defined in NEI 99-02.

## VIII. COMMITMENTS

None.